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Separation of Ownership and Control: Delegation as a Commitment Device

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Abstract

This paper provides a theoretical model for explaining the separation of ownership and control in firms. An entrepreneur hires a worker for providing effort to complete a project. The worker's effort determines the probability that the project is completed on time, but the worker receives unobservable benefits for every period she is employed. We show that hiring a manager on a short-term contract may increase the firm value and we identify the conditions under which separation of ownership and control is optimal. The model is consistent with empirical findings.

Keywords: control structure, moral hazard, private benefits, separation of ownership and control, soft-budget constraint, strategic delegation

JEL Classification: D86, G34, J31, L22, L26

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1 Introduction

Separation of ownership from control has generated a long literature in economics and finance. The first contributions go back to Berle and Means (1932) and even Adam Smith (1776). The stylized fact of this literature is the large corporation, which is owned by many small stockholders but is run centrally by professional managers, who have a negligible fraction of total ownership. The associated agency costs and the corporate mechanisms to combat them have been the central focus of the early literature on this topic¹.

Despite being challenged by recent empirical analyses², this stylized fact still reflects the situation for a substantial fraction of large corporations³. There are mainly two arguments provided for explaining the separation of ownership and control: (i) Shareholders do not have the ability, expertise or the knowledge to run firms, while managers do. (ii) The opportunity cost of time for large shareholders is high, namely they prefer leisure or starting a new company than dealing with management issues. Though perfectly valid, these arguments do not relate the firms' observable characteristics to their control structure, implying that the former are unrelated to the latter. However, this is not the case (see for example Demsetz and Lehn (1985)).

This paper proposes an alternative theoretical explanation on why investors may prefer to separate ownership from control and relates firm characteristics to the optimal choice of control structure. The main argument is that managers are “tougher” on workers than entrepreneurs, exactly because they may not have a large stake on its long-run prospects. Since a manager's payoff depends mainly on the short run returns of the

¹See Monsen and Downs (1965), Alchian and Demsetz (1972), Jensen and Meckling (1976), Fama (1980), Fama and Jensen (1983), and Demsetz (1983), Demsetz and Lehn (1985).

²See Porta, Lopez-De-Silanes, and Shleifer (1999), Holderness (2009)

³For example, Mikkelsen and Partch (1989) finds that the top three officials own less than 10 percent of the stock combined for 60 percent of the companies. Holderness, Kroszner, and Sheehan (1999) find that the average stock-holdings of a CEO is 1.25 percent (the median is only 0.06). Jensen and Murphy (1990) report similar findings.

firm, this makes her more likely to terminate currently unprofitable projects, even if they have positive long run NPV. Though this generates agency costs, it forces employees to work harder in order to avoid project terminations. Our setup is broadly consistent with empirical papers on management, which show that entrepreneurs care more about the long-run prospects of their firms and tend to foster long-term relationships with customers and employees (see for example Pruitt (1999), Miller and Le Breton-Miller (2005), James (2006), Arregle, Hitt, Sirmon, and Very (2007), Gomez-Mejia, Haynes, Nunez-Nickel, Jacobson, and Moyano-Fuentes (2007), Miller, Breton-Miller, and Scholnick (2008) for studies on family-owned firms).

In order to make this argument as clear and stark as possible, a simple two-period model with one entrepreneur and one worker is presented in section two of the paper. The entrepreneur is assumed to have full ownership and control over the firm and is not financially constrained⁴. She also owns a project, which may take two or three time periods to complete, and which increases the firm's profits once it is completed. The worker exerts non-verifiable effort, which increases the probability that the project is completed at the end of period two, but she receives an unobservable private benefit for every period she is employed in the project before its completion. As a result, the entrepreneur needs to compensate the worker for the loss of the private benefit, if she wants the project to complete sooner.

It is shown that, if the entrepreneur could commit to liquidate the project, then the worker would exert high effort at a lower wage. However, this threat is not credible, because the continuation value of the project is higher than the liquidation value. In fact, if the worker is sufficiently risk averse, the entrepreneur may prefer to provide

⁴In fact, it is irrelevant for our purposes if the firm has only one or many owners. We consider the case of an entrepreneur because it is the simplest possible and it allows us to distinguish the importance of the control structure (owners versus managers) from that of the ownership structure (large versus small shareholders). For the latter case, see the papers by Grossman and Hart (1980), Shleifer and Vishny (1986), Grossman and Hart (1988), Harris and Raviv (1988), Bebchuk (1994), Burkart, Gromb, and Panunzi (1997) and Burkart, Gromb, and Panunzi (1998).

no incentives for high effort. This problem is solved by hiring a manager and giving her a payment conditional only on period-two profits. This induces her to liquidate the project if it is delayed. The entrepreneur's time-inconsistency problem is solved and the worker exerts effort for a fixed payment. Thus, delegation of control strictly increases the owner's payoff.

The model is extended in section 3 with the addition of a moral hazard problem from the manager's side. This allows us to study the more plausible case, where giving up control to the manager may generate undesirable consequences (i.e. agency costs). We provide the optimal managerial contract and we examine the conditions under which separation of ownership and control is optimal.

The main contributions of this paper are twofold. First, the optimal managerial contract in our setting is a ***short-term contract*** which gives the manager a constant fraction of profits. Even though we do not intend to provide a general theory of optimal contract duration, this result goes against the current theoretical literature on the optimality of long-term contracts over short-term (Shavell (1979), Laffont and Tirole (1988)), or the equivalence between the two classes (Fudenberg, Holmstrom, and Milgrom (1990))⁵. The main intuition behind it is that the time-inconsistency problem of the entrepreneur, the fact that she does not want to liquidate a delayed project, is solved by the provision of myopic incentives to the manager (no remuneration after period two). Moreover, since the release of control to the manager generates agency costs (profit appropriation), it is optimal to reduce the duration of her employment in the firm, which makes a short-term contract optimal.

Second, we provide a theoretical model for the separation of ownership and control which is consistent with empirical findings. That is, in our model, separation of ownership and control is: (i) positively correlated with project size, (ii) negatively correlated

⁵See also (Thadden, 1995).

with profit variability, and (iii) positively correlated with firm age. These predictions are consistent with the findings of Demsetz and Lehn (1985) and Claessens, Djankov, and Lang (2000). One prediction of the model, that has not been tested empirically yet is that manager-controlled firms induce workers to exert more effort or exert effort more cheaply than entrepreneurial firms.

The interpretation of the worker's private benefits is important in our model. In the relevant literature they are often interpreted as the unobservable part of output, which is appropriated by the worker (e.g. Holmstrom and Tirole (1997), Pagano and Volpin (2006)). In our case, they are better interpreted as any perk or benefit of employment, which can not be included in the wage contract, because it is unobservable or non-verifiable, and which is not offered by the worker's *next-best employment opportunity*. This could be due to the firm's geographical position (proximity to residence), social networks within the organization (friendly working environment, similarly minded colleagues), reputation or career effects (organizational prestige and reputation), or any other factor.

What is crucial for our argument to go through is that the level of private benefits is not controlled by the firm's decision maker. Also, these benefits may either be unobservable, so that they are not compensated by the wage offer, or the wage may be set before the choice of employee is made (as in the case of blue collar workers). Moreover, since most employees apply to similarly paid jobs and usually have more than one job offer, it is plausible that the employee's decision is made on the grounds of these benefits.

There are several strands of literature related to our own. First, models of separation of ownership and control are provided by other papers. The early literature (Jensen and Meckling (1976), Fama (1980), Fama and Jensen (1983), and Demsetz (1983)) recognized the existence of agency costs in the firm and examined how the ownership

and control structure is used in order to combat them. But they did not explain why the decision power had to be delegated to managers in the first place.

More recently, Acemoglu (1998) explains the separation of ownership and control as a signal of the entrepreneur to financial markets about the quality of her project. Our paper does not relate the presence of managers to financial markets but to the internal workings of the firm. Manager's role is also different: they are not used as signaling devices but as a commitment devices.

Ferreira, Ornelas, and Turner (2010), based on Ornelas and Turner (2007), examine the separation of ownership and control in a model of optimal dissolution of partnership. Two partners allocate ex-ante and ex-post ownership rights in order to optimize ex-post incentives in revealing their type and allocating optimal control rights. Thus, their model is one of shareholders reaching an agreement on who should run the firm, while this paper adopts the principal-agent framework. Moreover, the main friction in their model is one of hidden types, while in this paper it is one of hidden actions.

Our explanation of separation of ownership and control is based on strategic delegation (Schelling (1980), Katz (1991), Fershtman and Gneezy (2001), Bensaid and Gary-Bobo (1993), Bester and Sakovics (2001), Gerratana and Koçkesen (2012)). This literature examines how principals delegate their actions to agents as a form of strategic precommitment (see for example Sklivas (1987), Caillaud, Jullien, and Picard (1995), Bond and Gresik (2011)). However, in these papers, the focus is on how delegation can be used to improve the bargaining power of the principal when competing against other principals (for example in a Cournot game of duopoly as in Sklivas (1987) or as in Zhang and Zhang (1997), Kopel and Riegler (2006), Kopel and Riegler (2008) or as in Jansen, van Lier, and van Witteloostuijn (2007)). While, in our paper strategic delegation is used in order to increase the bargaining power of the principal within the firm itself and make her “tougher” against workers. As a result, the duration of the

contract with the agent matters in our setting, a dimension which is absent from the present strategic-delegation literature. Moreover, an issue that often arises in these papers (and it also appears in ours) is the renegotiation-proofness of the principal's original agreement with the agent. We examine conditions under which the possibility of renegotiation does not destroy the commitment effects of delegation in section 4.1.

Our paper can also be categorized in the soft-budget-constraint literature (Dewatripont and Maskin (1995), Dewatripont and Roland (2000) and Kornai, Maskin, and Roland (2003)). In effect, the entrepreneur in our model faces a soft-budget constraint: if the project is delayed she does not want to liquidate it, even though this is optimal ex-ante. Dewatripont and Maskin (1995) propose decentralization as the solution to soft-budget-constraint problems, while we propose delegation as an alternative solution.

Issues of time-inconsistency and commitment have been examined in many other contexts, most notably in public policy (Kydland and Prescott (1977), Barro and Gordon (1983)). Similarly to us, Rogoff (1985) considers delegation to an agent with a different objective function than the principal as a solution to these problems. The main difference between his paper and ours is that in Rogoff (1985) this difference is exogenous: the agent has intrinsically different preferences from the principal. In our paper the difference in objectives arises endogenously: it is through the managerial contract, which provides, by construction, myopic incentives to the manager, that the principal aligns her ex-post objectives to the ex-ante.

More generally, the paper is related to the theoretical literature regarding delegation. This literature focuses on how to design the action-set of the agent optimally, but takes delegation of decision power as given. Examples of this literature are Holmstrom (1984), Faure-Grimaud, Laffont, and Martimort (2003) and Alonso and Matouschek (2008). As we noted before, delegation of decision power is endogenously determined in our model.

Finally, the paper is related to the literature on deadlines, which examine how

deadlines are used in order to mitigate dynamic moral hazard problems. Examples of this literature are the papers by Toxvaerd (2006), Toxvaerd (2007), Mason and Valimaki (2008), Bonatti and Horner (2011). The main difference is that deadlines mitigate free-riding problems within a team, while we deal with a time-inconsistency problem.

To summarize, we believe that the main contributions of this paper are the following: (i) It shows how the separation of ownership and control can act as a commitment device, which increases workers' effort and generates firm value. (ii) The optimal managerial contract is a short-term contract, which provides myopic incentives. (iii) The trade-off between optimal worker effort and agency costs relates firm-characteristics to the optimal choice of control structure and generates empirical predictions, which are consistent with the existing literature.

2 A Simple Model

There are four time periods: $t = \{0, 1, 2, 3\}$ and two agents: the entrepreneur (E) and the worker (W). E is risk neutral. W's utility is quasi-linear: $U_W = u(w) - c(e)$, where $u(x)$ is a concave function: $u' > 0$, $u'' < 0$, w is W's wage in monetary terms and $c(e)$ is the cost of effort. Effort is unobservable and there are two effort levels: High (\bar{e}) and Low (\underline{e}), with corresponding effort costs \bar{c} and \underline{c} .

E owns a firm which generates profits ρ_t at the end of periods two and three⁶. ρ_t is a random variable, normally and independently distributed in each period, with mean τ and variance σ^2 : $\rho_t \sim N(\tau, \sigma^2)$. E can increase the firm's average profits (τ) by hiring W at $t = 0$ in order to complete a project. After signing the contract, W exerts effort, which takes place also at (or just after) $t = 0$. The chosen effort level determines the probability that the project will be completed on time.

⁶For simplicity we assume that the firm generates no profit at $t = 1$. Even though our mathematical expressions become more complicated, none of our results changes if we relax this assumption.

If W exerts high effort then the project is completed on-time (*state o*) at $t = 2$ with probability \bar{p} and it is delayed (completed at $t = 3$: *state d*) with probability $1 - \bar{p}$. If the project is completed on-time, then it generates additional profits V_o for the firm in periods two and three. In other words, for every realization of ρ_t , firms' profits are $\rho_t + V_o$, implying that expected profits increase to $\tau + V_o$ in each period. The delayed project does not yield any additional profits in period two ($V_{d2} = 0$) and yields additional profits only in period three: $V_{d3} = V_d$. Similarly, if W exerts low effort the project is completed on time with probability \underline{p} and is delayed with probability $1 - \underline{p}$.

We assume that the project is more valuable if it is completed on-time ($2V_o > V_d > 0$) and that exerting high effort is efficient: $\bar{p} > \underline{p}$, $\bar{c} > \underline{c}$, $\Delta p(2V_o - V_d) > \Delta c$, where $\Delta p = \bar{p} - \underline{p}$ and $\Delta c = \bar{c} - \underline{c}$.

At $t = 1$ E finds out whether the project will be delayed or not. Then, she can choose either to liquidate the project ($L = 1$) and forgo V_d or to let the project continue ($L = 0$). If E liquidates the project, then profits increase by V_l at $t = 2$ and remain unchanged at $t = 3$ ($V_{l2} = V_l$, $V_{l3} = 0$). This implies that the expected profits of the firm after liquidation are $\tau + V_l$ and τ for periods two and three respectively. We assume that $V_d > V_l > 0$. The liquidation value of the project can be interpreted as either the value that other firms are willing to pay in order to undertake the project or the scrap value for the assets invested in it. In either case, what is important is that the project generates positive synergies in E's firm, so that letting the project complete with delay generates more profits than liquidating it.

Whether the project is delayed or not is *private information* to the relevant decision maker at time $t = 1$ (E in this case) and is *non-verifiable*. The project's current status and its completion date are also *non-verifiable*. Moreover, E can not impose financial penalties to W (W is employed under *limited-liability*), so the wage contract \mathbf{w} satisfies $\mathbf{w} \geq 0$. These assumptions imply that E can not provide an incentive contract which

is conditional on the project's completion date or status. And because W is risk-averse with respect to the wage, providing incentives through the wage can be very costly.

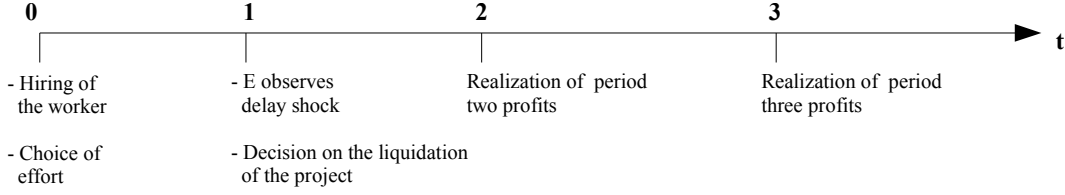
However, the liquidation decision may have an incentive effect, if W enjoys private benefits from being employed in the firm. More specifically, let us assume that for every period that W is employed in E 's firm, she receives additional utility equal to b , which we call *private benefit*. b enters W 's utility linearly: $U_W = u(w) + b - c(e)$.

The usual interpretation of this term in the literature is the unobservable part of output, which is appropriated by W (e.g. Holmstrom and Tirole (1997), Pagano and Volpin (2006)). Here it is better interpreted as any perk or benefit of her employment, which can not be included in the wage contract, because it is unobservable or non-verifiable, and which is not offered by W 's *next-best employment opportunity*. This effect maybe due to the geographical position of the firm, its proximity to her residence, the friendly working environment or the good relations with her colleagues, the esteem that she enjoys from working in a reputable firm or any other factor that is firm-specific. The important assumptions are that b accrues over time and that E does not control it directly.

Overall, the above assumptions allow us to capture a complex working environment in a simple way, where it is impossible or very costly to disentangle the state of the project from the normal operations of the firm and where it is very difficult to motivate the worker based on state-contingent contracts⁷. Even the utility that W receives from being employed is not fully controlled by E , due to the unobservable benefits b . The figure below presents the timing of events so far.

Let us examine the value of the liquidation decision in this set-up. Since W 's effort level, the project's status and E 's liquidation decision are unobservable and non-

⁷Holmstrom and Milgrom (1987) show how simple linear contracts can be optimal if there are several dimensions of unobservability. Even though our environment is more specific than theirs, we get a result of similar flavor: complex contracts can not do better than simple flat-rate contracts.



verifiable, the wage contract can be made contingent only on the realized level of profit and on the time periods: $w(\pi_t^w, t)$. In terms of notation, if π_t^w are the (verifiable) profits, upon which the wage contract can be made contingent, L_s is the liquidation decision in state s ($s = \{o, d\}$), V_{st} is the non-liquidated project's value in state s and period t , and V_{lt} is the liquidated project's value in period t , then $\pi_t^w = \rho_t + (1 - L_s)V_{st} + L_s V_{lt}$ ⁸.

Hence, π_t^w is a random variable, normally distributed with mean $\tau + (1 - L_s)V_{st} + L_s V_{lt}$. Let $f(\pi_t^w | \mu)$ denote the density function of π_t^w conditional on its mean μ . Then, if the project is completed on time, $\mu_o = \tau + V_o$ in both periods, if the project is delayed $\mu_{d2} = \tau$, $\mu_{d3} = \tau + V_d$, and if the project is liquidated $\mu_{l2} = \tau + V_l$, $\mu_{l3} = \tau$. Therefore, W's expected utility is equal to:

$$\begin{aligned}
 E_{\pi^w}(U_w) = & p(e) \left\{ b + (1 - L_o) \left[b + \int_{-\infty}^{+\infty} u(w(\pi_2^w, 2)) f(\pi_2^w | \mu_o) d\pi_2^w \right] \right\} \\
 & + (1 - p(e)) \left\{ b + (1 - L_d) \left[2b + \int_{-\infty}^{+\infty} u(w(\pi_2^w, 2)) f(\pi_2^w | \mu_{2d}) d\pi_2^w + \int_{-\infty}^{+\infty} u(w(\pi_3^w, 3)) f(\pi_3^w | \mu_{3d}) d\pi_3^w \right] \right\} - c(e)
 \end{aligned} \tag{1}$$

The first term on the right-hand-side is the expected utility of the project completing

⁸Also recall that $V_{o2} = V_{o3} = V_o$, $V_{d2} = 0$, $V_{d3} = V_d$, $V_{l2} = V_l$, $V_{l3} = 0$.

on-time. Then W receives the private benefit of the first period plus the benefit and the wage of the second period, conditional on no-liquidation. Equivalently, the second term is the expected utility of the delayed project. Since delay implies that the worker stays with the firm until $t = 3$ (conditional on no-liquidation), W receives the private benefit of the first period plus the wages and benefits of periods two and three⁹.

If E does not liquidate the project in the case of delay ($L_o = L_d = 0$), then, for inducing high effort, she needs to provide the wage schedule $\hat{\mathbf{w}}$ with (see the appendix for details):

$$\hat{w}(\pi_2^w, 2) = (u')^{-1} \left[\frac{\bar{p}f(\pi_2^w|\mu_o) + (1 - \bar{p})f(\pi_2^w|\tau)}{\lambda[f(\pi_2^w|\mu_o) - f(\pi_2^w|\tau)]} \right]$$

$$\hat{w}(\pi_3^w, 3) = 0$$

Moreover, if W is sufficiently risk-averse, the cost of inducing high effort may exceed the value of on-time completion. Then E would prefer to provide no wage to the worker and induce an increase in the probability of delay. This is the case when $E_{\pi_2^w}(\hat{w}_2) \geq \Delta p(2V_o - V_d)$. If, however, E liquidates after she finds out that the project is delayed, then she can induce high effort by paying (see the appendix for details):

$$\bar{w}_2 = u^{-1} [\max\{0, (\Delta c/\Delta p) - b\}]$$

One can show (see the appendix) that E's expected payment to induce high effort is lower in the latter case (when she liquidates). Moreover, it takes a higher degree of risk-aversion for the expected payment to exceed the value of on-time completion. Therefore, liquidation can be valuable to E either by reducing the cost of inducing high

⁹Hence, we assume that W is fired with no wage and no compensation if the project is liquidated. If the project is not liquidated, W remains in the firm until the project is completed and receives the wage and the benefits of the corresponding periods.

effort or by making high effort profitable.

However, it is not a credible threat. Because the continuation value of the project is strictly greater than the liquidation value ($V_d > V_l$), it is not a best-response for E to liquidate the project after delay. Since W anticipates that, exerting high effort is impossible. In other words, E suffers from a time-inconsistency problem, which is essentially a soft-budget constraint¹⁰. How can she deal with it? The solution is to hire a manager under a contract which provides a payment conditional on short-run (period-one) profits.

To see this, suppose that E can not impose financial penalties to M (the manager), and consider the following simple contract. M is hired to control the firm for period one only, i.e. M is given the authority to determine L at time $t = 1$, and her reward y_2 is a linear function of the period two profits: $y_2 = \epsilon \pi_2^m$, where $\pi_2^m = E_{\pi_2^w} \{\pi_2^w - w(\pi_2^w, 2)\}$ and ϵ_2 is a small, positive constant. Under this contract, M prefers to let the project continue if there is no delay, since $V_o > V_d$, while she prefers to liquidate it if the delay occurs ($V_l > 0$). This solves the time-inconsistency problem of the entrepreneur and allows her to complete the project on time.

The main intuition is that the manager does not suffer from the time-inconsistency problem that the entrepreneur faces, because her payoff is constructed through the contract and does not depend on the primitives of the economy. As a result, the delegation of control to the manager can relax the incentive compatibility of the worker and this increases the entrepreneur's payoff. In other words, the separation of ownership and control is optimal from the entrepreneur's point of view in this economy¹¹.

¹⁰See the papers by Dewatripont and Maskin (1995), Dewatripont and Roland (2000) and Kornai, Maskin, and Roland (2003).

¹¹Note that the simple contract proposed in this sub-section is not renegotiation-proof. We return to this issue in subsection 4.

3 A Model with Managerial Moral Hazard

3.1 The Manager

In this section we allow for more general results by including a moral hazard problem from the manager's side. Thus the rents earned by the manager reduce the value of delegation for the entrepreneur and generate a trade-off between worker incentives and control incentives.

In order to make this point, we consider an extreme form of moral hazard, where the manager can appropriate part of profits, before any wages are paid, and transform them into private benefits or non-pecuniary rewards at an exogenously given and constant return factor q , with $0 < q < 1$. That is, for every single unit of profit that the manager appropriates, proportion q is transformed into utility for the manager and proportion $1 - q$ is lost as appropriation cost.

As before, there are four periods, $t = \{0, 1, 2, 3\}$. The entrepreneur E and the Manager M are risk neutral, but the worker W is risk-averse with respect to the wage (we assume the same quasi-linear utility as in section 2). The discount factor is one for all agents and the firm is owned in its entirety in the beginning of period zero by E. Both W and M are protected by limited liability (non-negative rewards).

E decides at $t = 0$ if she runs the firm or if she delegates control to M. ρ_t is the random stream of profits in periods two and three ($\rho_t \sim N(\tau, \sigma^2)$) and W's effort (e) determines the probability that the project is completed on-time. All the variables with respect to the project ($e, p(e), c(e), V_{st}, V_{lt}, L_s$) and their interaction remain as in section 2.

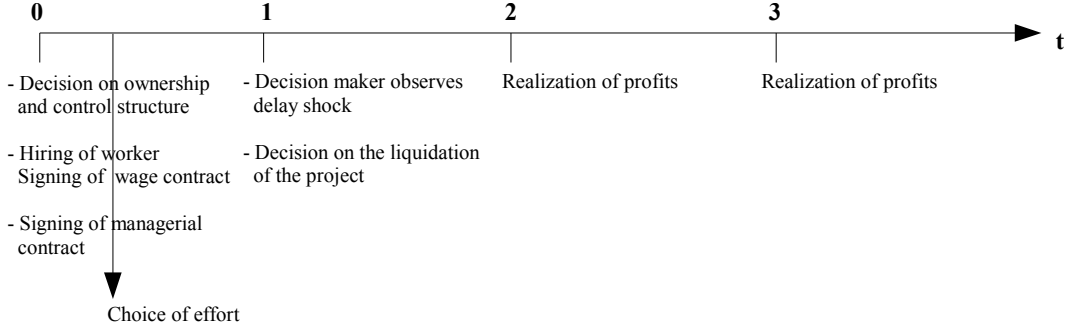
The new element is that M, after observing the "internal" profits $\pi_t^m = \rho_t + (1 - L_s)V_{st} + L_s V_{lt}$ (profits before wages), decides to appropriate a part of them ($r_t(\pi_t^m)$). A fraction q of appropriated profits becomes managerial utility, while the remaining $(1 -$

$q)r_t(\pi_t^m)$ becomes deadweight-loss for the firm. Because the projects status, its returns and profit appropriation are observable only by the decision maker in the firm (M in the case of delegation), only the profits after appropriation are verifiable: $\pi_t^w = \pi_t^m - r_t(\pi_t^m)$. This implies that the wage contract is contingent on profits after appropriation and on time periods: $w(\pi_t^w, t)$, while the managerial contract and entrepreneurial returns are contingent on profits after wages: $\pi_t^e = \pi_t^w - w(\pi_t^w, t)$ (after wages profits), $y_t(\pi_t^e)$ (managerial contract/reward in period t), $u_e = \pi_t^e - y_t(\pi_t^e)$ (entrepreneurial returns). Overall, the following list of profits clarifies the different definitions and assumptions.

- **before appropriation profits:** $\pi_t^m = \rho_t + (1 - L_s)V_{st} + L_s V_{lt}$ (unobservable/non-verifiable)
- **after appropriation profits:** $\pi_t^w = \rho_t + (1 - L_s)V_{st} + L_s V_{lt} - r_t(\pi_t^m)$ (verifiable)
- **after wages profits:** $\pi_t^e = \rho_t + (1 - L_s)V_{st} + L_s V_{lt} - r_t(\pi_t^m) - w(\pi_t^w, t)$ (verifiable)

We also assume that E can choose the managerial contract's duration (δ). That is, E may hire M for only the first period ($\delta = 1$), after which M is fired (i.e. she receives no future payments by E) and E resumes control of the company. We call this the **short-term** contract. Or E may hire M for both periods ($\delta = 2$), which we call the **long-term** contract. Overall, the managerial reward is determined by profits after wages and duration: $\{y_t(\pi_t^e|\delta)\}$.

The timing of events is as follows. At $t = 0$ E hires W under the contract $\mathbf{w}(\pi_t^w, t)$ and decides whether to delegate control to M or not and for how long by offering the contract $\{\mathbf{y}_t(\pi_t^e|\delta)\}$ to M. At $t = 1$, the firm's decision maker (either E or M, depending on the delegation decision) decides whether to liquidate the project or not (after having observed whether there is a delay of the project or not). Firm's profits and agents' payoffs are then realized at periods $t = \{2, 3\}$. The figure below shows this timing.



3.2 Optimal Managerial Contract

We first examine the case where E decides to delegate control to M and we determine the optimal managerial contract. The optimal contract is the solution to the following problem:

$$\max_{y_1(\pi_1^e|\delta), y_2(\pi_2^e|\delta), \delta} \left\{ \sum_{s=0}^1 p_s(e_w) \left[\sum_{t=2}^3 \int_{-\infty}^{+\infty} (\pi_t^e - y_t(\pi_t^e|\delta)) f(\pi_t^e|\mu_t) d\pi_t^e \right] \right\} \quad (2)$$

subject to:

$$\{r_t(\pi_t^m), L\} = \operatorname{argmax} \left\{ \sum_{s=0}^1 p_s(e_w) \left[\sum_{t=2}^3 \int_{-\infty}^{+\infty} (y_t(\pi_t^e|\delta) + qr_t(\pi_t^m)) f(\pi_t^m|\mu_t) d\pi_t^m \right] \right\} \quad (3)$$

Since the only potential benefit from delegating control to M is reducing the wage that induces W to exert high effort, we examine only the optimal managerial contract which induces M to liquidate the project under delay. We implicitly assume that E

provides the corresponding contract \bar{w} to W , which was defined in section 2¹². Any other incentives for M can not generate more value to E than the value E receives by retaining control of the firm.

Thus, problem (2)-(3) is equivalent to maximizing equation (2) under three incentive compatibility conditions: (i) In the end of each period M should be indifferent between appropriating part of the profits or not. (ii)-(iii) After M is informed whether the project is completed on time or not, she should liquidate the project, if it is delayed, and she should not liquidate it otherwise. Given the above incentive compatibility conditions, Proposition 1 presents the optimal managerial contract. The proof is provided in the appendix.

Proposition 1 *The optimal managerial contract is a **short-term linear contract** with payment $y_1^*(\pi_1^e | \delta = 1) = q\pi_1^e$, if profits are positive and zero otherwise.*

We leave the comparative statics for the next subsection and we make a few notes on the form and interpretation of the managerial contract. The managerial contract is similar to a call option with exercise price zero. This is because it makes no payment to the manager, if profits are negative, and starts to pay-out when profits are positive. Moreover, the manager receives a constant proportion of the profits. The first part of the managerial contract is a direct implication of limited liability, while the second part is due to the ability of the manager to divert profits into private benefits.

More interestingly, the optimal managerial contract is a *short-term* contract. This is due to the interplay of two forces: the time-inconsistency problem of the entrepreneur, whose solution requires “myopic” (front-loaded) incentives, and the agency-costs born

¹²It is easy to show that, conditional on M liquidating the project under delay, \bar{w} is the optimal wage.

by the release of control. In the absence of the time-inconsistency problem E would not hire M (“zero” contract duration), while in the absence of profit appropriation, the optimal short-term and long-term contracts would be equivalent. Admittedly, our setup does not provide a general framework for analyzing optimal contract duration. Nonetheless, it does provide an example where short-term contracts dominate long-term contracts, a result that is not present in the current literature.

3.3 Optimal Control Structure and Comparative Statics

We now examine the value of the firm under the two ownership structures and the conditions under which the entrepreneur prefers to separate ownership from control. In the analysis that follows we consider the more interesting case, where W is sufficiently risk averse, so that E prefers to induce low effort, if she retains control. Thus, we can contrast the costs and benefits of the two ownership structures in terms of efficient provision of incentives for the worker versus managerial rents. This assumption also gives the more plausible result, that the worker’s wage is independent of profits.

Therefore, if E retains the control of the firm at $t = 0$, she pays the minimum wage to the worker (in our model this is $w = 0$), she continues the project, even if it delayed, and the firm’s expected value (V^E) is equal to:

$$V^E = 2\tau + \underline{p}2V_o + (1 - \underline{p})V_d$$

On the other hand, if E separates ownership from control, then E provides the efficiency wage \bar{w} to W and the contract of Proposition 1 to M at $t = 0$. At $t = 1$, M liquidates the project only if it is delayed. Then the firm’s expected value (V^M) to E is equal to:

$$V^M = 2\tau - \bar{w} + \bar{p} \left[2V_o - q \int_0^{+\infty} \pi_2^e f(\pi_2^e | \mu_{eo}) d\pi_2^e \right] + (1 - \bar{p}) \left[V_l - q \int_0^{+\infty} \pi_2^e f(\pi_2^e | \mu_{el}) d\pi_2^e \right]$$

where: $\mu_{eo} = \tau + V_o - \bar{w}$ and $\mu_{el} = \tau + V_l - \bar{w}$. By directly comparing V^E to V^M , we see that E prefers to separate ownership from control iff:

$$2V_o \Delta p \geq (1 - \underline{p})V_d - (1 - \bar{p})V_l + \bar{w} + E(y_2(\pi_2^e)) \quad (4)$$

where $E(y_2(\pi_2^e))$ is the expected payment to the manager:

$$E(y_2(\pi_2^e)) = q \left[\bar{p} \int_0^{+\infty} \pi_2^e f(\pi_2^e | \mu_{eo}) d\pi_2^e + (1 - \bar{p}) \int_0^{+\infty} \pi_2^e f(\pi_2^e | \mu_{el}) d\pi_2^e \right]$$

Therefore, E separates ownership and control whenever the increase in the value of the project through the higher probability of completion on-time exceeds the efficiency wage to W and the expected value of rents to M. The comparative statics of equation 4 are summarized in the following corollary of Proposition 1:

Corollary 1 *The entrepreneur is more likely to separate ownership from control if¹³:*

- *The ability of the manager to appropriate profits (q) decreases.*
- *The value of the completed project increases (V_o).*

¹³Here, the term “likely” refers to whether the set of parameters that satisfy equation 4 increases or not as one of them changes. One can justify this term by imagining that there is a probability distribution over the set of parameters value, which provides the percentage of firms with the same characteristics and which gives the total probability of a firm belonging to one control structure or the other, as evaluated by the cumulative distribution conditional on equation (4). The mental exercise is, therefore, to examine what happens to this probability, conditioning on a small change around a specific value of one parameter. A similar interpretation is given by Tirole (2001).

- *The differential impact of effort on incentives (Δp) increases, by increasing the left-hand side of (4) and by decreasing \bar{w} .*
- *The efficiency wage \bar{w} decreases, either because Δp or b increases or because Δc decreases.*
- *The variance of the firm profits (σ^2) increases.*

The interpretation of most of these comparative statics is straightforward. We briefly discuss the most interesting implications.

3.3.1 Optimal control structure and profit variability

An increase in the variance of profits (σ^2) increases the expected payment to the manager, $E[y_2(\pi_2^e)]$, and decreases the value of separation of ownership and control. This is because an increase in σ^2 makes high-profit states more likely. Since the managerial reward is an increasing function of profits, so as to prevent rent extraction, higher variance increases the expected reward of the manager and, hence, the expected cost for the entrepreneur. This model prediction is also consistent with the empirical studies on this topic (Demsetz and Lehn, 1985).

3.3.2 Optimal control structure and firm size

An important empirical finding in the literature is that separation of ownership and control is positively correlated with firm size (Claessens, Djankov, and Lang (2000), Faccio and Lang (2002)). The model is consistent with this finding if we consider an increase in the value of the project. This is because, if the value of the project increases in both states (so that $dV_o = dV_d = dv$), the increase in the value of the completed project contributes in both periods ($t = 2$ and $t = 3$) while the increase in the value of

the delayed project contributes only in period $t = 3$. Hence, condition (4) becomes less restrictive which means that firms of larger size (in terms of project value) are more likely to separate ownership from control.

The opposite holds if the increase in the firm size is due to an increase in the mean value of the stream of random profits τ . In this case, the expected managerial reward increases, causing the right-hand side of (4) to increase. Hence, separation of ownership and control becomes less likely¹⁴.

Also note that, in terms of prediction, our model can be distinguished from simpler theories which relate firm size to the separation of ownership and control. For example, if firms separate ownership from control simply because they need funds to grow, then one would expect that the largest shareholders/blockholders of the firm are also its managers. This is because the moral hazard of running the firm is mitigated by retaining a higher fraction of ownership. In our model this means that (\mathbf{IC}_1) (page 30 of the appendix) is relaxed as the manager holds more equity. However, this prediction is not consistent with empirical findings (see Jensen and Murphy (1990) and Holderness, Kroszner, and Sheehan (1999)). On the contrary our model is consistent with managers not being the largest blockholder of their firms and, in fact, not having a stake in the ownership of the firm at all.

3.3.3 Optimal control structure and firm age

Another empirical finding is that separation of ownership and control is positively correlated with firm age (Demsetz and Lehn (1985), Claessens, Djankov, and Lang (2000)). The model can be made consistent with this finding as well, if firm owners acquire better monitoring abilities over time. This could be because, through the accumulation

¹⁴In an earlier version of the paper we showed that an increase in the number of projects implies that separation of ownership and control is more likely. The argument is very similar to the argument used for the increase in project profitability.

of experience over time, the owner understands better how the firm is run and this reduces the managements ability to appropriate profits. Then q goes down with firm age and the expected value of separation of ownership and control increases for older firms. Therefore, we should expect a positive correlation between firm age and separation of ownership and control, as it is confirmed by empirical studies.

4 Discussion

There are some theoretical issues of the model of the previous section, which we have left for discussion in this section for the interested reader. We discuss each one in turn in order to demonstrate that our model is robust to certain theoretical concerns.

4.1 Renegotiation-Proofness

In the models of sections 2 and 3 we showed that separation of ownership and control is a solution to the entrepreneur's problem. However, this solution is not renegotiation-proof. This is because, after the manager finds out that the project is delayed, she can contact the entrepreneur and ask for a contract renegotiation or for a fixed payment in order to give back the control of the firm to the entrepreneur. This makes the solution non-credible and destroys the incentives of the worker to exert high effort.

As previous papers have shown (see Dewatripont (1988), Fudenberg and Tirole (1990), Ma (1991)), the problem of renegotiation-proofness can be overcome by introducing additional frictions in the model. Even though we kept the model simple and tractable so far, one can easily examine extensions of the model in section 3 which include adverse selection with regards to the project quality. For example, suppose that at the time of contracting ($t = 0$), the project quality is unknown to both E and M. With probability ϕ the project will turn out to be of high quality, yielding returns

V_o^H , V_d^H and V_l^H in the respective states, and with probability $1 - \phi$ will be of low quality, yielding V_o^L , V_d^L and V_l^L . In general $V_s^H > V_s^L$.

Now assume that at time $t = 1$ M learns not only whether the project is delayed but also its quality, so that renegotiation takes place under asymmetric information on the value of the project. Then one can show (formal arguments are presented in the appendix) that the entrepreneur has to pay both types of managers the continuation value of the “high”-manager contract in order to convince them to renegotiate. But, if the additional cost for the entrepreneur from overpaying the “low”-type manager exceeds the value of renegotiation, then E prefers not to renegotiate at the high-type’s continuation value. Hence renegotiation with high-type managers is impossible and delegation is still valuable if the ratio of high-to-low types is not too low (see the appendix)¹⁵.

4.2 Optimality of the Mechanism

We now consider two alternative solutions to the problem we have presented in the previous sections. We also discuss under what conditions they are preferred to delegation or not. The first one is a governmental policy, which taxes away all profits of the firm in period two. The second one is issuing claims on the profits of the firm to financial markets.

As far the the first one is concerned, taxing away the profits of period two destroys the continuation value of the project and makes the threat of liquidation credible. This is because, as soon as E finds out that the project is delayed, she prefers to sell it. The result is the same as delegating decision power to the manager: E can reduce the

¹⁵The same argument can be made with a continuum of types. In this case, if the adverse selection problem is severe, the entrepreneur would not renegotiate the contract for any manager type, apart the lowest possible, leading to a complete collapse of the renegotiation process and the ex-ante optimality of delegation. The formal treatment of this argument is available by the author upon request.

efficiency wage of the worker and increase her payoff.

However, the policy is not costless for the entrepreneur. Since the continuation of the project increases average profits for the firm in period two, the governmental policy can solve the time inconsistency problem of E only if it taxes away *all* of the profits of the firm in this period. Therefore, the expected cost of the policy is equal to τ . Hence, taxing away profits is a better mechanism than delegation only if the expected profit of the firm in period two (excluding the project value) is less than the expected payment of the manager. Otherwise, separation of ownership and control remains an optimal solution.

The second solution is more interesting. The entrepreneur can issue financial claims on the future stream of profits of the firm in the beginning of period one and sell them to financial markets. One such financial claim is for instance a claim on all profits of period two, which can be sold for a price equal to τ . Another potential claim is the one which replicates the state-contingent payoff of the entrepreneur in period two when delegation is used, which is sold for a price equal to V^M ¹⁶.

Both of these claims work equally well. The first one replicates the effects of the governmental policy, discussed above, while the second one replicates the incentives provided by the managerial contract. Moreover, both of them have the additional benefit that the entrepreneur retains the value of the claims she is selling by receiving the price. Indeed, for the models of section 2 and 3, selling financial claims is a costless way for the entrepreneur to commit not to continue the project, if a delay occurs. In other words, delegation is useless in terms of our model, if well functioning financial markets are available.

The main issue, however, with this solution is that financial markets usually suffer from adverse selection. While we have avoided to complicate the model for the sake

¹⁶It is essentially the financial claim which promises the payment $\pi_2^e - y_2(\pi_2^e)$ when the firm profit is π_2^e and where $y_2(\pi_2^e)$ is provided by equation 7 in the Appendix.

of expositional clarity, it is easy to make the point here. If the initial profitability of the firm is observable to the entrepreneur but not to outsiders, then any claim issued by a high quality entrepreneur will suffer a market discount and this is the true cost of financial markets. If this is sufficiently high then the entrepreneur may still prefer to delegate control to a manager, who suffers from moral hazard, than issue underpriced securities. In other words, we effectively handicapped delegation as a potential solution to E's problem when we added managerial moral hazard to the problem, while we assumed perfect information about the quality of the firm. But a fair comparison between delegation and the use of financial markets requires to consider the information problems on both sides¹⁷.

From the above discussion, we conclude that delegation is an optimal way to solve the time-consistency problem of the entrepreneur (or, at least, a subset of entrepreneurs) if the managerial moral hazard is not severe enough (q is low), if the expected profits of the firms are high (τ is high), and if financial markets suffer from severe adverse selection. Therefore, even though the solution we propose is not always an optimal solution, it remains the only optimal solution under a subset of parameter values.

¹⁷The model of section 3 can easily accommodate both sides of the problem. Just let two different types of firms, one with high profits, τ_H , and one with low profits, τ_L , where the type of the firm is private information to the entrepreneur at the start of the period. Then, for a sufficiently high enough difference of profits between the two types, type H entrepreneurs find it optimal to hire a manager and avoid the mispricing of their securities, while type L entrepreneurs prefer the financial markets. Note that even though one prediction of this extension is the same as in Acemoglu (1998) (high quality firms hire a manager, low quality firms do not), there is an important difference. In our model firms do not require external capital and only low quality firms sell securities to the markets, while in Acemoglu (1998) firms need financial capital for investment and, in equilibrium, all of them borrow from financial markets. In other words, in Acemoglu (1998), delegation is used as a signaling device to financial markets, while for us markets is a competing mechanism to delegation and operates as a commitment device.

4.3 Participation Constraints

In section 3 we simplified the analysis by omitting the participation constraints of the manager and the worker. Since both of them have a non-negative utility in equilibrium, the results of the previous section remain the same if we were to assume that the outside option for both M and W is equal to zero. Here, we discuss how these results change with the inclusion of more general participation constraints.

First, let o^w and o^m denote the outside options for the worker and the manager respectively. Clearly, if the outside option of the worker is less than the efficiency wage under delegation (\bar{w}), then the cost of hiring her remains unchanged under both control structures. Therefore, the preferred control structure also depends on the outside option of the manager. If o^m is below the expected value of the optimal managerial contract, then our results remain unchanged. If o^m lies above the expected value of the managerial contract, then the cost of hiring the manager is o^m . By substituting o^m for $E(y_2(\pi_2^e))$ in (4), we get that separation of ownership and control is optimal iff $o^m \leq 2V_o\Delta p - (1 - \underline{p})V_d + (1 - \bar{p})V_l - \bar{w}$.

In the case where o^w is equal or above \bar{w} , but less than $E_{\pi_2^w}(\hat{w}_2)$, then separation is optimal iff $2V_o\Delta p \geq (1 - \underline{p})V_d - (1 - \bar{p})V_l + o^w + \max\{o^m, E(y_2(\pi_2^e))\}$. Finally, in the case where o^w exceeds $E_{\pi_2^w}(\hat{w}_2)$, then there is no benefit from delegation and the only optimal control structure is the combination of ownership with control.

5 Conclusion

The paper presents a simple model of delegation of corporate control from an entrepreneur to a manager. Thus, it provides a theoretical reasoning for the separation of ownership and control in modern firms. The main reasoning behind the model is that managers can impose penalties to procrastinating workers more credibly than en-

trepreneurs, because, by the construction of their contract, they do not care about the long-run value of the firm as much as its owners. Thus, they provide incentives to workers to exert high effort and generate firm value.

On the other hand, the introduction of managers in the firm generates agency costs in the form of appropriation of profits for the provision of private benefits to the top management. This trade-off between low-tier and higher-tier benefits characterizes the optimal choice of control structure and provides interesting comparative statics. The model predictions are consistent with the findings of the empirical literature.

Moreover the model provides an interesting theoretical prediction: short-term contracts may dominate long-term contracts if the principal prefers to induce front-loaded incentives and the release of control generates agency costs. We provide this result with a simple model. Nonetheless, we find it interesting and leave its generalization for future research.

Appendix

Optimal Wage Contracts

(a) Suppose that E wants to induce W to exert high effort. First, consider the case when E does not liquidate after delay: $L_d = 0$. E's problem is to maximize her expected return subject to the incentive compatibility constraint of W:

$$\begin{aligned} \max_{\mathbf{w}} \quad & p(e) \left[2(\tau + V_o) - \int_{-\infty}^{+\infty} w(\pi_2^w, 2) f(\pi_2^w | \mu_o) d\pi_2^w \right] \\ & + (1 - p(e)) \left[2\tau + V_d - \int_{-\infty}^{+\infty} w(\pi_2^w, 2) f(\pi_2^w | \mu_{2d}) d\pi_2^w - \int_{-\infty}^{+\infty} w(\pi_3^w, 3) f(\pi_3^w | \mu_{3d}) d\pi_3^w \right] \end{aligned}$$

subject to:

$$\begin{aligned} & \bar{p} \left[2b + \int_{-\infty}^{+\infty} u(w(\pi_2^w, 2)) f(\pi_2^w | \mu_o) d\pi_2^w \right] \\ & + (1 - \bar{p}) \left[3b + \int_{-\infty}^{+\infty} u(w(\pi_2^w, 2)) f(\pi_2^w | \mu_{2d}) d\pi_2^w + \int_{-\infty}^{+\infty} u(w(\pi_3^w, 3)) f(\pi_3^w | \mu_{3d}) d\pi_3^w \right] - \bar{c} \geq \\ & \underline{p} \left[2b + \int_{-\infty}^{+\infty} u(w(\pi_2^w, 2)) f(\pi_2^w | \mu_o) d\pi_2^w \right] \\ & + (1 - \underline{p}) \left[3b + \int_{-\infty}^{+\infty} u(w(\pi_2^w, 2)) f(\pi_2^w | \mu_{2d}) d\pi_2^w + \int_{-\infty}^{+\infty} u(w(\pi_3^w, 3)) f(\pi_3^w | \mu_{3d}) d\pi_3^w \right] - \underline{c} \end{aligned}$$

W's incentive compatibility condition can be rewritten as:

$$\int_{-\infty}^{+\infty} u(w(\pi_2^w, 2)) [f(\pi_2^w | \mu_o) - f(\pi_2^w | \mu_{2d})] d\pi_2^w - \int_{-\infty}^{+\infty} u(w(\pi_3^w, 3)) f(\pi_3^w | \mu_{3d}) d\pi_3^w \geq \frac{\Delta c}{\Delta p} + b$$

Clearly, the derivative of the Lagrangian for this problem with respect to w_3 is negative, hence the optimal wage at period three is zero: $\hat{w}(\pi_3^w, 3) = 0$. With respect to \hat{w}_2 , we have:

$$\frac{\partial L}{\partial w_2} = -p(e) f(\pi_2^w | \mu_o) - (1 - p(e)) f(\pi_2^w | \mu_{2d}) + \lambda u'(w_2) [f(\pi_2^w | \mu_o) - f(\pi_2^w | \tau)] = 0$$

By recalling that $\mu_{2d} = \tau$ and by rearranging, we have:

$$\hat{w}(\pi_2^w, 2) = (u')^{-1} \left[\frac{\bar{p}f(\pi_2^w|\mu_o) + (1 - \bar{p})f(\pi_2^w|\tau)}{\lambda[f(\pi_2^w|\mu_o) - f(\pi_2^w|\tau)]} \right]$$

(b) Similarly, for the case when E liquidates after delay ($L_d = 1$):

$$\max_{\mathbf{w}} p(e) \left[2(\tau + V_o) - \int_{-\infty}^{+\infty} w(\pi_2^w, 2) f(\pi_2^w|\mu_o) d\pi_2^w \right] + (1 - p(e))(2\tau + V_l)$$

subject to:

$$\int_{-\infty}^{+\infty} u(w(\pi_2^w, 2)) f(\pi_2^w|\mu_o) d\pi_2^w \geq \max \left\{ 0, \frac{\Delta c}{\Delta p} - b \right\}$$

By setting the first order derivative of the Lagrangian with respect to w_2 equal to zero and rearranging, we get:

$$u'(w_2) = \frac{\bar{p}}{\lambda}$$

The right-hand side of the above equation is constant, implying that w_2 is a constant. Hence:

$$\int_{-\infty}^{+\infty} u(\bar{w}_2) f(\pi_2^w|\mu_o) d\pi_2^w = \max \left\{ 0, \frac{\Delta c}{\Delta p} - b \right\} \Rightarrow$$

$$\bar{w}_2 = u^{-1} [\max \{0, (\Delta c/\Delta p) - b\}]$$

Note that, if b is sufficiently high ($b > \Delta c/\Delta p$), then E can induce high effort even when she pays zero wage to the worker and irrespectively of W's risk aversion.

(c) Finally, we show that the E's expected payment to W under $L_d = 1$ is lower than under $L_d = 0$. In the latter case, because W's incentive compatibility is binding and $\hat{w}_3 = 0$, we have:

$$\int_{-\infty}^{+\infty} u(\hat{w}_2) f(\pi_2^w|\mu_o) d\pi_2^w - \int_{-\infty}^{+\infty} u(\hat{w}_2) f(\pi_2^w|\mu_{2d}) d\pi_2^w = \frac{\Delta c}{\Delta p} + b > \frac{\Delta c}{\Delta p} - b \Rightarrow$$

$$\int_{-\infty}^{+\infty} u(\hat{w}_2) f(\pi_2^w|\mu_o) d\pi_2^w > \frac{\Delta c}{\Delta p} - b$$

Therefore, there exists some payment $x > 0$, such that:

$$\int_{-\infty}^{+\infty} u(\hat{w}_2 - x) f(\pi_2^w | \mu_o) d\pi_2^w = \frac{\Delta c}{\Delta p} - b$$

But, this implies that the wage schedule $\hat{w}_2 - x$ satisfies W's incentive compatibility when $L_d = 1$. However, as we showed in part (b), above, $\hat{w}_2 - x$ is not optimal in this case, as it forces W to bear risk. Hence:

$$\bar{w} < \int_{-\infty}^{+\infty} \hat{w}_2 f(\pi_2^w | \mu_o) d\pi_2^w - x < \int_{-\infty}^{+\infty} \hat{w}_2 f(\pi_2^w | \mu_o) d\pi_2^w$$

The above inequalities prove our claim.

Proof of Proposition 1

First we write the incentive compatibility constraints (i)-(iii) in page 17. We then show that the optimal managerial contract is always a short-term contract. Finally we solve for the optimal short-term contract.

Recall that $\mu_t = \tau + (1 - L_s)V_{st} + L_s V_{lt}$ is the mean of the random variable π_t^m and that $\pi_t^e = \pi_t^m - r_t(\pi_t^m) - w(\pi_t^w, t)$. I_δ is an indicator function which takes the value 1 if the contract is long-term and takes the value 0 if the contract is short-term. $u_t^m = y_t(\pi_t^m - r_t(\pi_t^m) - w(\pi_t^w, t)|\delta) + qr_t(\pi_t^m)$ is M's utility for a given realization of π_t^m . The three incentive compatibility conditions for the problem are:

$$r_t(\pi_t^m) = \operatorname{argmax}\{y_t(\pi_t^m - r_t - w(\pi_t^w, t)|\delta) + qr_t\}, \quad \forall \pi_t^m \in (0, +\infty), t \in \{2, 3\} \quad (\text{IC}_1)$$

$$L = 1 | s = d \quad \Leftrightarrow \quad \int_{-\infty}^{+\infty} u_2^m f(\pi_2^m | \mu_{2l}) d\pi_2^m + I_\delta \int_{-\infty}^{+\infty} u_3^m f(\pi_3^m | \mu_{3l}) d\pi_3^m \geq \int_{-\infty}^{+\infty} u_2^m f(\pi_2^m | \mu_{2d}) d\pi_2^m + I_\delta \int_{-\infty}^{+\infty} u_3^m f(\pi_3^m | \mu_{3d}) d\pi_3^m$$

$$\text{where: } \mu_{2l} = \tau + V_l, \quad \mu_{3l} = \tau, \quad \mu_{2d} = \tau, \quad \mu_{3d} = \tau + V_d \quad (\text{IC}_2)$$

$$L = 0 | s = o \quad \Leftrightarrow \quad \int_{-\infty}^{+\infty} u_2^m f(\pi_2^m | \mu_o) d\pi_2^m + I_\delta \int_{-\infty}^{+\infty} u_3^m f(\pi_3^m | \mu_o) d\pi_3^m \geq \int_{-\infty}^{+\infty} u_2^m f(\pi_2^m | \mu_{2l}) d\pi_2^m + I_\delta \int_{-\infty}^{+\infty} u_3^m f(\pi_3^m | \mu_{3l}) d\pi_3^m$$

$$\text{where: } \mu_o = \tau + V_o, \mu_{2l} = \tau + V_l, \mu_{3l} = \tau \quad (\mathbf{IC}_3)$$

In order to show that short-term contracts dominate long-term contracts, first we analyze \mathbf{IC}_1 . By differentiating \mathbf{IC}_1 with respect to r_t , we find that the manager is indifferent between extracting more rents or reporting the true profits if $\frac{\partial y_t}{\partial \pi_t^e} = q$. This means that the managerial contract is an increasing function of reported profits, with slope at least equal to q in order to prevent the manager from extracting private benefits. Otherwise, the manager has the incentive to appropriate in the neighborhood of any realized profit where her contract is non-increasing. By doing so, she does not reduce her compensation while extracting private benefits for herself. Clearly, the expected payment is minimized when $y_t = q\pi_t^e$.

Consider any long-term contract $y^L = \{y_2(\pi_2^e | \delta = 2), y_3(\pi_3^e | \delta = 2)\}$ which satisfies \mathbf{IC}_1 - \mathbf{IC}_3 . We have established that y^L is increasing in profits in both periods. Consider now the short-term contract $y^S = \{y_2(\pi_2^e | \delta = 1) = y_2(\pi_2^e | \delta = 2)\}$. That is y^S offers the same payment schedule as y^L for the first period, after which the manager is fired. y^S offers a lower expected payment to M than y^L , since M receives no second period payment. Therefore, y^S strictly increases E's utility over y^L .

Furthermore, y^S also satisfies the incentive compatibility conditions. To see this, first, y^S satisfies \mathbf{IC}_1 for period one by construction. Second, \mathbf{IC}_3 is also satisfied (when we set $I_\delta = 0$), because the mean of the random variable π_2^m is higher under continuation ($\mu_o = \tau + V_o$) than under liquidation ($\mu_{2l} = \tau + V_l$). Since the managerial contract is an increasing function of profits (by \mathbf{IC}_1), the expected payment for the manager is higher when the mean of π_t^m is higher. It remains to show that \mathbf{IC}_2 is also satisfied by y^S . By substituting the values for μ_t in \mathbf{IC}_2 and by rearranging, the constraint writes in the case of y^L as follows:

$$\int_{-\infty}^{+\infty} u_2^m [f(\pi_2^m | \tau + V_l) - f(\pi_2^m | \tau)] d\pi_2^m \geq \int_{-\infty}^{+\infty} u_3^m [f(\pi_3^m | \tau + V_d) - f(\pi_3^m | \tau)] d\pi_3^m \quad (5)$$

IC₁ implies that $r_3(\pi_3^m) = 0$. Therefore, since $\tau + V_2 > \tau$ and u_2^m is an increasing function of π_2^m , the right hand side of (5) is strictly positive. However, because $u_2^m = 0$ under a short-term contract, the same constraint writes in the case of y^S as:

$$\int_{-\infty}^{+\infty} u_2^m [f(\pi_2^m | \tau + V_l) - f(\pi_2^m | \tau)] d\pi_2^m \geq 0 \quad (6)$$

Therefore, if $y_2(\pi_2^e | \delta = 2)$ satisfies (5) then it also satisfies (6) and therefore y^S also satisfies **IC**₂. This means that y^S provides a smaller expected payment to M and it also strictly relaxes **IC**₂. Hence, any incentive compatible long-term contract is dominated by a short-term contract. For simplicity, we drop the notation δ and period three payments for the rest of the proof and we solve for the optimal short-term contract.

By limited liability, $y_2(\pi_2^e) = 0$ if $\pi_2^e < 0$. By **IC**₁, $y_2(\pi_2^e) \geq q\pi_2^e$ if $\pi_2^e \geq 0$. Consider the contract with the minimum-expected payment which satisfies **IC**₁ and limited liability:

$$y_2 = \begin{cases} 0, & \text{if } \pi_2^e < 0 \\ q\pi_2^e, & \text{if } \pi_2^e \geq 0 \end{cases} \quad (7)$$

We show that the above contract satisfies **IC**₂-**IC**₃. In evaluating M's utility from the above contract, we take into account that the optimal wage is set to \bar{w} by E, which is constant. By substituting the above payments for u_2^m in (6), **IC**₂ writes as:

$$q \int_0^{+\infty} (\pi_2^m - \bar{w}) [f(\pi_2^m | \mu_{2l}) - f(\pi_2^m | \mu_{2d})] d\pi_2^m \geq 0$$

Since $\frac{\partial}{\partial \mu} \left[\int_0^{+\infty} (\pi_2^m - \bar{w}) f(\pi_2^m | \mu) d\pi_2^m \right] > 0$ and $\mu_{2l} = \tau + V_l > \mu_{2d} = \tau$, the left hand side of the above equation is strictly positive and **IC**₂ is satisfied. Similarly for **IC**₃:

$$q \int_0^{+\infty} (\pi_2^m - \bar{w}) [f(\pi_2^m | \mu_o) - f(\pi_2^m | \mu_{2l})] d\pi_2^m \geq 0$$

Since $\mu_o = \tau + V_o > \mu_{2l} + \tau + V_l$, **IC**₃ is satisfied as well. Therefore, the contract in (7) minimizes the rents paid to M due to **IC**₁ and also satisfies **IC**₂ and **IC**₃. Hence, (7) provides the optimal managerial contract. ■

Renegotiation under Adverse Selection

Consider the model of section 3 with the extension of subsection 4.1. We examine the renegotiation issue by assuming that E (the uninformed party) makes renegotiation offers to M (the informed party). We also assume that once E has delegated control to M, she can not fire her and take over the firm without M's consent. That is, since the managerial contract specifies the duration of the agreement, M can always enforce it through courts and remain in control of the firm up to $t = 2$. Therefore, if E wants to avoid liquidation, she needs to compensate M by paying her a lump-sum transfer or renegotiating the original contract, so that M receives at least the continuation utility of the previous contract.

After $t = 1$, M has two sources of private information, which E does not know: whether the project is delayed or not and the project's type (high: H or low: L). However, if the project is to be completed on-time, E has no incentive to renegotiate, as she can not improve on the outcome (she would take the same liquidation decision as M and she still needs to compensate M from leaving the firm). Therefore, E wants to renegotiate with types Hd and Ld but not with types Ho and Lo .

Let $E_{js}(y)$ be the expected value of contract y for type js , where $j \in \{H, L\}$ and $s \in \{o, d\}$. Also, let $\{\hat{y}^H, \hat{y}^L\}$ be the menu of renegotiation contracts that E offers to M after $t = 1$ in exchange for M releasing control of the firm. Implicitly, the menu of contracts is a function of the realized profit level at $t = 2$: $\hat{y}^j(\pi_2^e)$. Finally, recall that y_2 is the outside option for M, the original (pre-renegotiation) managerial contract, as defined in (7). Given the above, we show that a separating equilibrium at the renegotiation stage does not exist. Such an equilibrium requires the following incentive compatibility conditions:

$$E_{Ho}(y_2) \geq \max\{E_{Ho}(\hat{y}^H), E_{Ho}(\hat{y}^L)\} \quad (8)$$

$$E_{Hd}(\hat{y}^H) \geq \max\{E_{Hd}(\hat{y}^L), E_{Hd}(y_2)\} \quad (9)$$

$$E_{Lo}(y_2) \geq \max\{E_{Lo}(\hat{y}^H), E_{Lo}(\hat{y}^L)\} \quad (10)$$

$$E_{Ld}(\hat{y}^L) \geq \max\{E_{Ld}(\hat{y}^H), E_{Ld}(y_2)\} \quad (11)$$

Examining only contracts \hat{y}^H , \hat{y}^L , inequalities (9) and (11) can be rewritten as:

$$\int_0^{+\infty} [\hat{y}^H(\pi_2^e) - \hat{y}^L(\pi_2^e)] f(\pi_2^e | \tau) d\pi_2^e \geq 0 \quad \text{and}$$

$$- \int_0^{+\infty} [\hat{y}^H(\pi_2^e) - \hat{y}^L(\pi_2^e)] f(\pi_2^e | \tau) d\pi_2^e \geq 0$$

In the above inequalities we have used the fact that, if both types accept their respective contracts and renegotiate, then E takes over the firm, does not liquidate and therefore the expected mean profit at period $t = 2$ is equal to τ . Clearly, both inequalities hold at the same time if and only if $\hat{y}^H = \hat{y}^L$, which implies a pooling contract \hat{y} for types Hd and Ld . Also, since $E_{Hd}(y_2) > E_{Ld}(y_2)$, Hd 's participation constraint is binding and hence $E_{Hd}(\hat{y}) = E_{Hd}(y_2)$, which implies that E makes the same expected payment to both types in order for them to accept renegotiation. That is, in order to convince Hd to renegotiate, E must make the same payment to Ld .

Now, even if we ignore the remaining constraints from the analysis (which makes it easier for renegotiation to be valuable to E), we show that E may choose not to renegotiate the contract with M due to the additional costs of adverse selection. This is because, if she chooses to renegotiate, then she makes the payment $E_{Hd}(y_2)$ (conditional on types Ho and Lo rejecting the payment) in order to gain the average project continuation value $\phi[V_d^H - V_l^H] + (1 - \phi)[V_d^L - V_l^L]$. However, if E chooses not to renegotiate then she expects to pay M a smaller amount, conditional on state d : $\phi E_{Hd}(y_2) + (1 - \phi)E_{Ld}(y_2)$. Therefore, a necessary condition for renegotiation is:

$$E_{Hd}[y_2] - E_{Ld}[y_2] \leq \frac{\phi}{1 - \phi} (V_d^H - V_l^H) + (V_d^H - V_l^L)$$

Clearly, the above condition may fail if the difference between V_l^H and V_l^L is very high or if $V_d^j - V_l^j$ is very low for both types. Therefore, under some parameter values, E does not renegotiate with Hd types due to the high costs of adverse selection. Instead, E makes the payment $E_{Ld}(y_2)$, which only Ld types accept and renegotiates with them. In this case, the wage contract $\bar{w}(\phi) = u^{-1}[\max\{\Delta c / \Delta p - b(2\phi - 1)\}]$ still motivates W to exert high-effort (although not the optimal one) and therefore, as long as ϕ is not too low, separation of ownership and control remains optimal despite the presence of renegotiation.

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